

DOCUMENT RESUME

ED 198 002

SE 034 275

AUTHOR Monk, R. W.
 TITLE The Development of an Experiment in Higher Education of Utah for Industrial Ties and Educational Utilization: RESIA--Restructuring of Education in Science for Industrial Alignment.
 INSTITUTION Utah State Board of Higher Education, Salt Lake City.
 SPONS AGENCY National Science Foundation, Washington, D.C.
 PUB DATE 80
 GPANT NSF-SED75-16009
 NOTE 12p.: Contains occasional light and broken type.
 EDRS PRICE MF01/PC01 Plus Postage.
 DESCRIPTORS College Science: *Cooperative Programs: *Higher Education: *Industry: On the Job Training: *Professional Training: *School Business Relationship: Science Education: Science Instruction: Technical Education

ABSTRACT

Summarized is the Restructuring of Education in Science for Industrial Alignment (RESIA) project, a five-year effort in Utah to more closely link higher education with the educational needs of industry. During the first two years, college faculty, industrial supervisors, and training directors developed a total of 76 modules of course material in biology, chemistry, physics, and mathematics. These modules were designed so that industries could select portions of standard science courses for use in their personnel training programs. However, an evaluation group showed that few RESIA modules directly met industry's needs. A new organizational approach was adopted for the following three years; teams developed training materials for specific industries on a contractual basis. Many of the resulting instructional packages became important segments of university courses. This second approach successfully demonstrated that both industry and higher education can benefit from cooperative programs. (WB)

 * Reproductions supplied by EDRS are the best that can be made *
 * from the original document. *

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY.

THE DEVELOPMENT OF AN EXPERIMENT IN HIGHER

EDUCATION OF UTAH FOR INDUSTRIAL TIES

AND EDUCATIONAL UTILIZATION

R E S I A

"Restructuring of Education in Science

for Industrial Alignment"

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

Patricia Babb
of the NSF

TO THE EDUCATIONAL RESOURCES
INFORMATION CENTER (ERIC)."

SCOPE OF INTEREST NOTICE

The ERIC Facility has assigned this document for processing to:

SE HE

In our judgement, this document is also of interest to the clearinghouses noted to the right. Indexing should reflect their special points of view.

by R. W. Monk

Williams (1977) has suggested that both industry and higher education over any extended period should retain strong lines of communication for better understanding of educational needs and development of new techniques that utilize new knowledge. Regardless of the size of the industrial corporations -those with very small modest facilities or those with large international ties spending millions and employing thousands--industry is soon aware that the fields of technology and science are so diverse that few companies can maintain within themselves the resources necessary to train or retrain employees to effectively enter all of the new fields that are necessary to maintain their competitive position.

In order to more closely align higher education with the education needs of industrial firms, an experiment was designed and developed in Utah for higher education and industry and is now in its fifth year of operation. This project, known as RESIA (Restructuring Education in Science for Industrial Alignment), has utilized the knowledge and experience of faculty personnel from universities and colleges as well as that of industrial supervisors and training directors. In addition, the National Science Foundation has provided a National Advisory Committee consisting

of highly trained specialists representing universities and industry from across the nation. The developmental processes have required many months of intense activity and years of preparation. The experiences gained have been evaluated and utilized in developing a system which could realistically have national impact.

Method of Approach:

Prior to the initiation and generation of this project, representatives from all state universities and colleges in science disciplines met together and developed a concept of life-long learning for college/university students and industrial employees. The plan was to make all science courses flexible enough so that any needed portion of a standard science course could be selected for training. The mechanism by which this was to be accomplished was to develop modules of standard science course material worth approximately one-half credit hour. This would allow students to select only those parts of a traditional course of value to them. An entire introductory fifteen credit-hour math course, for example, would become thirty modules.

A module was described as an independent unit of instruction with a primary focus on well-defined behavioral objectives. By using the modular approach to course design, prospective students from both higher education and trainees in industry, would have more flexibility and control in meeting their educational and skill/training needs. The program is in contrast to the traditional lecture-oriented lock-step approach.

It was recognized in early stages of the developmental process of the project that not all state institutions of higher education in the state of Utah could assist in the processes of aligning higher education with industry. Two were not in close geographic proximity to industries of any size and a third, a two-year technical college, was located in the same community as

the large state university which had agreed to participate.

From the beginning of this project, it was recognized that the magnitude of the task would require many highly trained and specialized personnel and a sizeable amount of resources to support project of mutual interest to industry and education. In light of this realization financial support was sought from the National Science Foundation which expressed considerable interest and, after careful study, made an on-site visit. N.S.F. staff members made some recommended changes in operational procedures; these included the employment of a National Advisory Committee and a Steering Committee. A series of workshops were recommended for training college and university faculty and for experimentation before large-scale development of instructional materials for industrial firms was undertaken. These recommendations were incorporated in an addendum to the proposal and sent to N.S.F.

After careful study, N.S.F. made a grant to the Utah System of Higher Education and to the Utah State Board of Regents. The designation of the Utah State Board of Regents System of Higher Education as the grantee was appropriate since it is the governing body of all Utah State owned colleges and universities. It was recognized by N.S.F. that this governing body does not directly handle the finances for institutions under its governance, thus Weber State College (Ogden, Utah), where the project director resided, was designated as the fiscal agent for all participating higher education institutions.

Under Utah State law an educational institution could not participate with another unless permission to operate individually was granted under a sub-contract. Thus the operation of the colleges and universities in a consortium (consortium; fellowship; partnership union) in the strict sense

was not possible.

Project Development (First Two Years):

To accomplish the proposed tasks and solve many of the university/college relationship problems, a series of workshops were first held. Faculty members from all involved institutions were brought together at off-campus facilities, and out of state specialists, Dr. Edwin B. Kurtz and Douglas Hale from the University of Texas Permian Basin, were utilized to train faculty members in the preparation of modules with behavioral objectives. An important manual that was used for these workshops was developed by Dr. Kurtz and Associates, (1971). These workshops were useful in identifying the optimum direction of development and in building a close working relationship between faculty members and industrial representatives.

Some important contributions which emerged from the workshops and faculty conferences were: (1) closer working relations among the faculty members of all participating institutions from the same disciplines', (2) better understanding of differences in course content for identical hierarchical levels and segments of disciplines, (3) cooperative effort of faculty members of all state institutions to develop beginning course materials identical in all state institutions, (4) a recognition that methods of instruction in universities and colleges are generally individualistic even though these techniques may not be considered ideal.

The project operation was designed with a project director, an assistant project director, an institutional representative from each institution and an educational coordinator over each of the major science disciplines (biology, chemistry, physics, mathematics, engineering), in addition a continuing education coordinator was also employed. The

organizational structure was designed to (a) prevent duplication of effort, (b) utilize a vast background of expertise in all disciplines and (c) encourage the development of modules that would be useful to industry.

In the development of the project three factors considered to be advantageous were:

1. Geographical isolation would be overcome by students being trained at small centers or on the job.
2. Career options could be broadened by allowing employees and students to review learning packages from a variety of industrial activities.
3. Students could take preliminary training from many industries to determine the feasibility of continuing studies in a given field, thus reducing costs of education because retraining would become unnecessary. In actuality the latter two advantages were never realized because industrial relations were eventually focused and directed by instructional developers.

In the disciplines of biology, chemistry, geology, mathematics, physics and in many applied related areas, i.e. electronics, electricity, computer science, numerical control, meteorology, wild life management, and water and soil management, many training modules were developed. In this context, the term module was used to indicate the segments of standard college or university courses that were especially chosen to relate to industrial need.

As a result of the combined effort of science faculty from six institutions of higher education in Utah (University of Utah, Utah State University, Weber State College, College of Eastern Utah, Utah Technical College at Provo, and Southern Utah State College), seventy-six modules were developed in the following disciplines: Biology - 26, Chemistry - 23, Mathematics - 10, Physics - 17..

After two years of operation, an evaluation team pointed out that, although the modules produced were of value in the colleges and universities, little to no direct alignment with industry was being made. Even though some university/college courses are used directly to train employees, few of these courses met direct need. Thus a new system needed to be developed which would bring about closer alignment with industry. The Project Director, Steering Committee, the National Advisory Committee in conference with the evaluation team studied the problems and recommended that all the old organizational structure be deleted and that a new organizational structure be developed.

The newly recommended organizational structure included the project director and a deputy administrator (whose responsibility was to contact industrial firms and determine their needs and develop contracts to provide the needed training programs). The new organizational structure included the development of a team consisting of (1) instructional developers (individuals trained specifically in the science of instructional development who develop the total instructional package and act as team manager), (2) a subject matter specialist (expert, a faculty member with background and training in the technical subject matter area needed by an industry), (3) an industrial representative (a training officer from industry, knowledgeable in the needs and requirements of each particular industry involved), (4) a graphic artist (a person specifically trained in graphic representation of technical industrial equipment), (4a) as a counterpart of the graphic artist position is the graphic photographer (person who takes detailed, step by step pictures of the technical material to be learned or the technical operational procedure for industrial equipment),

(5) a writer editor to write the script at the level of understanding of the employee/student and to correct misstatements of thought on the part of those producing the script). All of these team members under the direction of the Instructional Developer worked together in developing the instructional learning package for industry. In the development of these packages at least two important concepts needed to be kept in the forefront. (1) The package must meet the needs of the industry. (2) It must in some way be useful in a college or university or no industrial-higher educational alignment could be made. Many motivational factors were considered by the instructional developers including assumptions regarding behavior and characteristics of employees as identified by McGregor (1960). It was found that an important motivating factor was the individualization and personalization of the instructional material. This was accomplished by taking actual photographs of employees and wherever possible utilizing these in the step-by-step descriptive instructional process. This proved to be the inducement necessary to get employees to want to learn and to improve themselves on the job.

Since these instructional packages were developed by faculty members, there was now a vehicle to develop a working symbiotic relationship for industry and higher education. Since in some cases these especially designed courses for industry were in fact important segments of university courses, the forefront of life-long learning was moving off the campus to the industrial site.

A number of contracts to develop training modules have been completed with various industrial firms. One which somewhat illustrates the developmental process and the interaction of a university professor with industry was produced for an engineering firm known as EIMCO. RESIA personnel

contracted to train machine operators in the use of newly purchased numerically controlled machines. A professor from the manufacturing engineering department at Utah State University was utilized as the subject matter specialist. He worked with a large number of engineers and machine operators at EIMCO. Management and design of the instructional program created an extremely functional program which could be used at the Salt Lake EIMCO plant or by industrial companies with similar training needs. Currently, the university professor uses the modules in his university courses teaching students to understand and use numerically controlled machines. Since the modules were both designed and used in an industrial setting, both students and the workers were the beneficiaries from production of the modules. It is a prime example where university students learn by performing an actual industrial technique. In working as the subject matter specialist, the professor found that his educational expertise was brought up to date.

Another project involved a number of professors, in the College of Natural Resources at Utah State University, who acted as subject matter specialists in the production of modules for the Utah State Department of Forestry and Fire Control. Among the many produced were Soils, Watershed Management, Recreational Management, Wildlife Management. These modules are also used in class at U.S.U. and by supervisors of U.S.D.F. and F.C. and have possible broad-scope use in many other areas. As faculty members developed these training programs, they are also brought up to date in the course materials. Other contracted projects include chemistry, modules for a baking soda manufacturing firm, Church and Dwight, Green River, Wyoming.

The development of complete training programs for the Western Zirconium

Company near Ogden, Utah was a completely different challenge for the RESIA management team. The Western Zirconium Company is a wholly-owned subsidiary of Westinghouse Electric Corporation and no plant building had been completed or put to use when RESIA contracted to develop their training programs. In this case the chemical engineers of the company were at the frontiers of the field and developed a specialized process; university and college professors had no experience with the company's specialized process and were unable to assist company engineers. Therefore the chemists of the company served as subject matter specialists. A specially selected team was utilized to provide the instructional development process which included production of all training modules. The use of the company subject matter specialists provided security to protect the patented chemical process. The chemical engineers had the opportunity to develop professionally by serving fellow employees and provide needed changes in training new employees. They also became acquainted with an important instructional process. Although it was not possible to get the higher education/industrial direct interchange as in most training programs, it did establish a relationship which may provide future training programs for this company.

RESIA's staff has contracted with a number of companies to develop training programs which are similar to these described in this paper.

SUMMARY AND CONCLUSIONS:

In an attempt to bring the college/university educational process in closer alignment with industrial training need, different techniques were explored. The beginning techniques were to fragment standard beginning science courses into small enough packages so that they could be

selected and utilized by industry in their training process and also to provide college/university student the opportunity to select those segments they deemed most useful to them.

After two years of work and experimentation, little to no industrial alignment had been made, therefore, a new system was devised and has been utilized for three years.

The new system utilizing a team of specially trained instructional developers with industrial firms representatives and college/university faculty members has proved to be most successful.

In conclusion it is possible to say that it is feasible to align higher education with industry and in the process bring important benefits to both industry and higher education.

Faculty members from higher education systems can be brought up to date in the specific discipline and can utilize this knowledge and these techniques in their classrooms. Industrial firms can directly utilize the expertise of many college/university faculties.

The total system developed by this project can be implemented nationwide and may have a national impact.

THE DEVELOPMENT OF AN EXPERIMENT IN HIGHER
EDUCATION OF UTAH FOR INDUSTRIAL TIES
AND EDUCATIONAL UTILIZATION

R E S I A

"Restructuring of Education in Science for
Industrial Alignment"

BIBLIOGRAPHY

McGregor, D., The Human Side of Enterprise New York: McGraw-Hill
1960

Walbesser, Henry H.; Kurtz, E.B.; Goss, L.D. and Robl, Richard M.
(1971) Constructing Instruction Based on Behavioral Objectives,
Engineering Publications Division of Engineering, Oklahoma
State University, Stillwater, Oklahoma.

Williams, Trevor I. (1977) Industry and the Universities, P. 43,
Endeavor, New Series Vol. 1, No. 2.